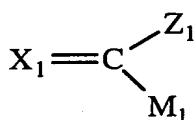


Claims

What is claimed is:

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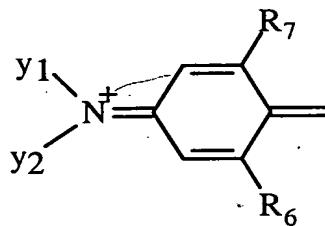
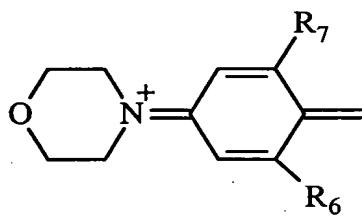
1. A photoinitiator having the following formula:



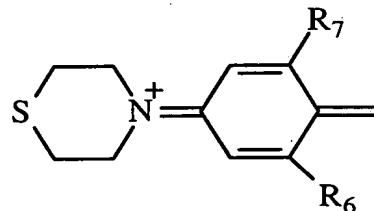
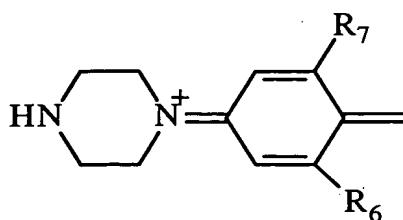
wherein X_1 comprises a conjugated system of one or more aryl groups or substituted aryl groups; Z_1 comprises $-O$, $-S$, an alkyl group having from one to six carbon atoms, an ester moiety, a ketone moiety, an amine moiety, an imine moiety, an ether moiety, an aryl or substituted aryl group, a metal or non-metal, or a metal or non-metal containing group; and M_1 comprises an alkyl group, a substituted alkyl group, or forms a five-member ring with Z_1 .

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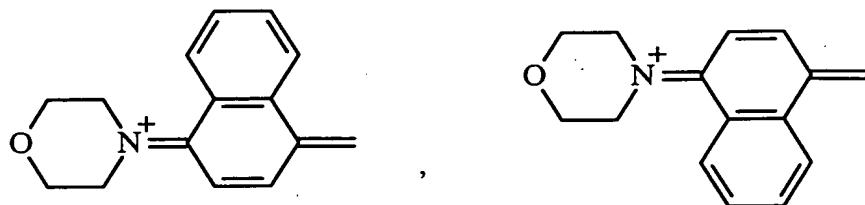
2. The photoinitiator of Claim 1, wherein X_1 comprises



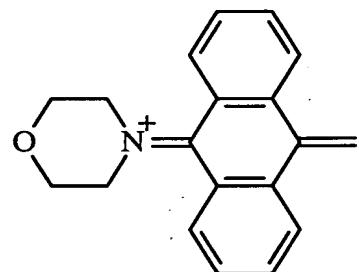
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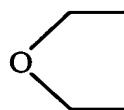
58



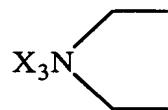
or



5 wherein R₆ and R₇ each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group; and wherein y₁ and y₂ each independently represent a hydrogen, an alkyl group having from one to six carbon atoms, an aryl group,



or



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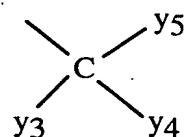
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wherein X₃ represents a hydrogen, an alkyl or substituted alkyl group, or an aryl or substituted aryl group.

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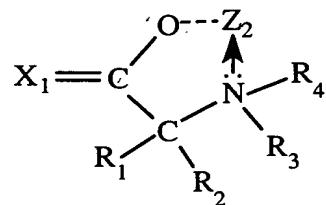
34. The photoinitiator of Claim 1, wherein M_1 comprises a tertiary alkyl group having the following formula:



wherein y_3 , y_4 and y_5 each independently represent a hydrogen, an alkyl group having from one to six carbon atoms, a tertiary amine group, an aryl group, or a substituted aryl group.

45. The photoinitiator of Claim 1, wherein M_1 and Z_1 form a five-member ring.

56. The photoinitiator of Claim 5, wherein the photoinitiator has the following structure:



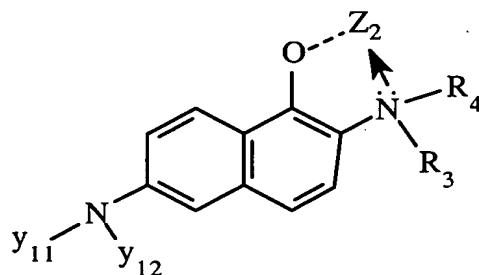
wherein Z_2 is a metal or non-metal atom, a metal or non-metal containing salt, or $-C(O)R$, which forms a covalent bond with the oxygen atom; R , R_3 and R_4 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group; and R_1 and R_2 are each independently a hydrogen atom, an alkyl or

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substituted alkyl group, or an aryl or substituted aryl group, or form one or more aromatic rings with X_1 .

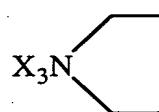
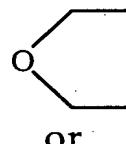
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7. The photoinitiator of Claim ~~6~~⁵, wherein R_1 , R_2 , and X_1 form a photoinitiator having the structure below:



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wherein y_{11} and y_{12} are each independently represent a hydrogen, an alkyl group having from one to six carbon atoms, an aryl group,



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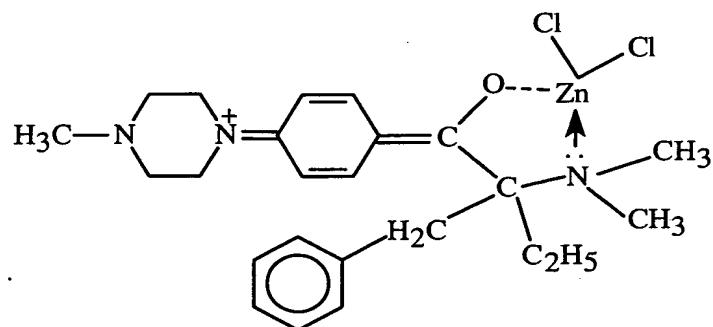
wherein X_3 represents a hydrogen, an alkyl or substituted alkyl group, or an aryl or substituted aryl group.

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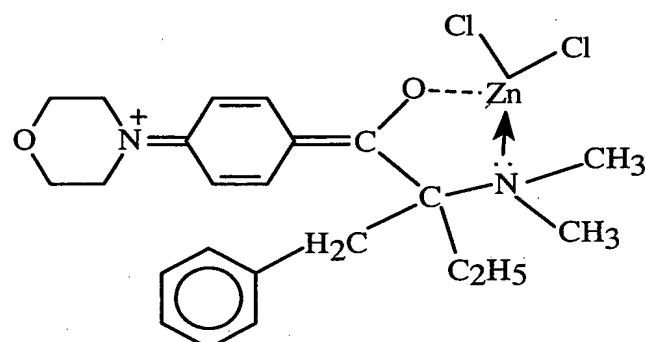
7. The photoinitiator of Claim ~~6~~⁵, wherein the photoinitiator comprises

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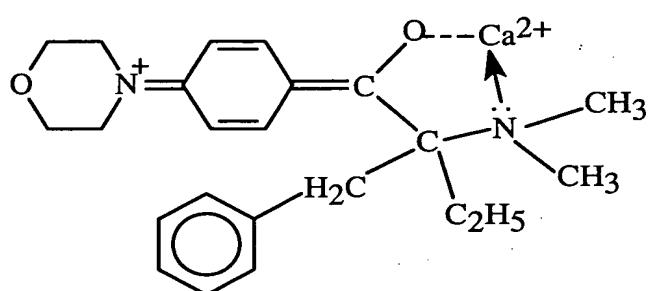


or



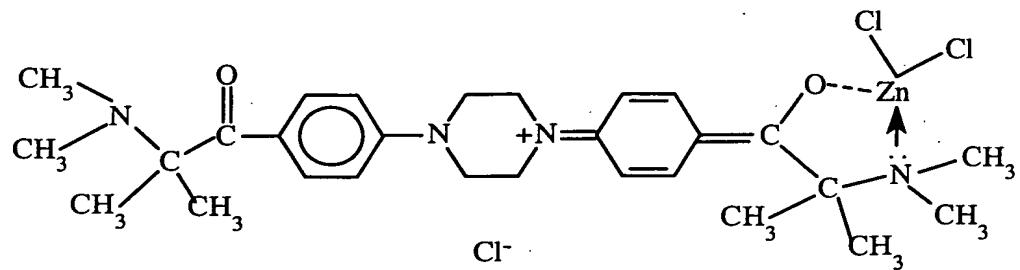
or

5



or

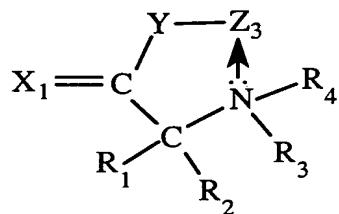
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8A. The photoinitiator of Claim 5, wherein the photoinitiator has the following structure:

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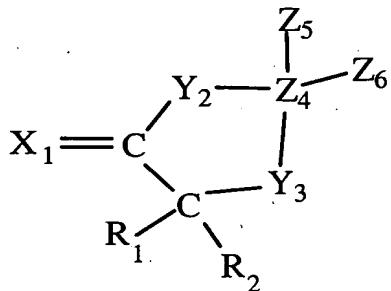
wherein Y is -O- or -N(R₅)-; Z₃ is a metal or nonmetal cation or a salt containing the cation; R₃ and R₄ are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group; and R₁ and R₂ are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group, or form one or more aromatic rings with X₁.

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9,10. The photoinitiator of Claim 5, wherein the photoinitiator has the following structure:



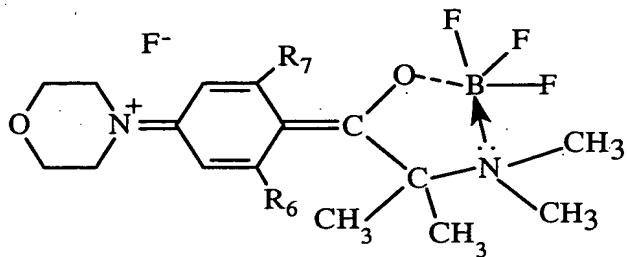
wherein Y_2 and Y_3 each independently represent $-O-$ or $-N(R_3)(R_4)-$; R_3 , and R_4 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group; R_1 and R_2 are each independently a hydrogen atom, an alkyl or substituted alkyl group, or an aryl or substituted aryl group or form one or more aromatic rings with X_1 ; Z_4 is a metal or nonmetal atom; and Z_5 and Z_6 are halogen-containing anions or form one or more rings with or without R_3 or R_4 .

~~10A1~~. The photoinitiator of Claim ~~10~~, wherein Z₄ comprises Cd, Hg, Zn, Mg, Al, Ga, In, Tl, Sc, Ge, Pb, Si, Ti, Sn, Zr, boron or phosphorus.

1142. The photoinitiator of Claim 10, wherein Z₅ and Z₆ each independently comprise fluorine, chlorine or bromine-containing anions.

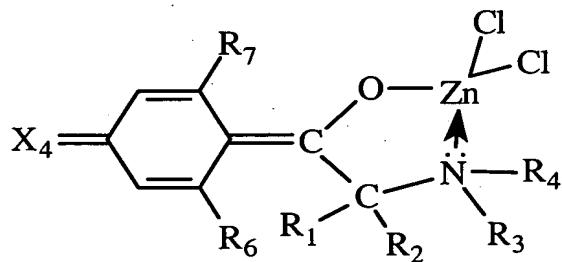
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P 13. The photoinitiator of Claim 10, wherein the photoinitiator comprises



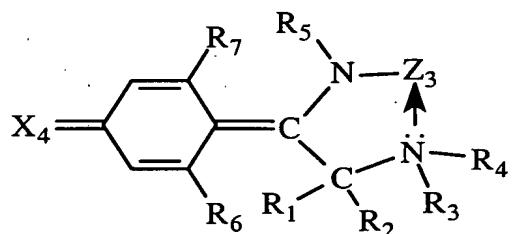
5 wherein R₆ and R₇ each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group.

10 *P* 14. The photoinitiator of Claim 10, wherein the photoinitiator has the following structure:



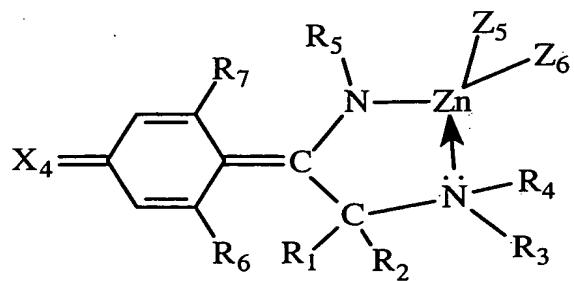
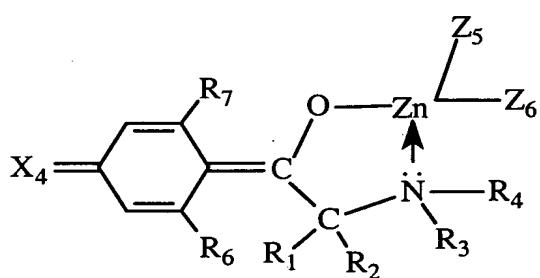
15 wherein X₄ comprises any nitrogen-containing group, which donates a pair of electrons to the nitrogen-carbon double bond; and R₆ and R₇ each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group.

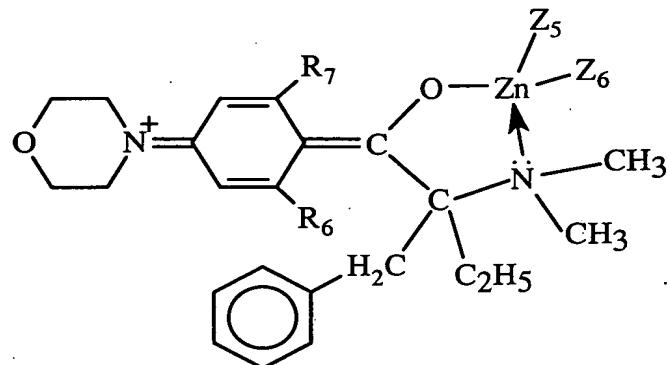
~~14~~ 15. The photoinitiator of Claim ~~8~~, wherein the photoinitiator has the following structure:



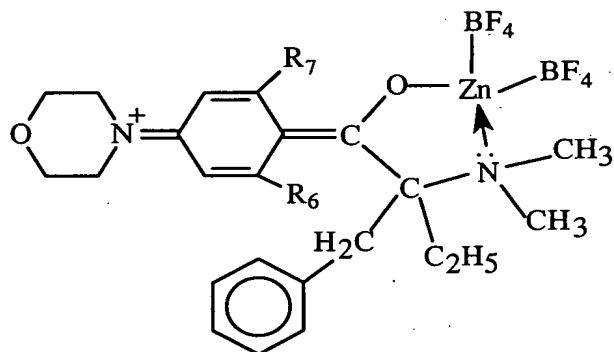
wherein X_4 comprises any nitrogen-containing group, which donates a pair of electrons to the nitrogen-carbon double bond; and R_6 and R_7 each independently represent hydrogen, an alkyl group having from one to six carbon atoms, an alkoxy group having from one to six carbon atoms, or a halogen-substituted alkyl group.

~~15~~ 16. The photoinitiator of Claim ~~10~~, wherein the photoinitiator has the following structure:





or



~~16~~ ~~17~~ 17. A method of generating a reactive species, comprising:

10 irradiating the cationic photoinitiator of Claim 1 with radiation.

~~17~~ ~~18~~ 18. A method of polymerizing a polymerizable material, comprising:

15 irradiating an admixture of a polymerizable material and the photoinitiator of Claim 1.